
Bridlestone Estates Preliminary Plat

TECHNICAL INFORMATION REPORT

Kirkland, Washington

Issued: December 15, 2014

Prepared For:
KLN Construction, Inc.

Prepared By:
Kevin C. Flynn, PE

Reviewed By:
Roy E. Lewis, Jr., PE

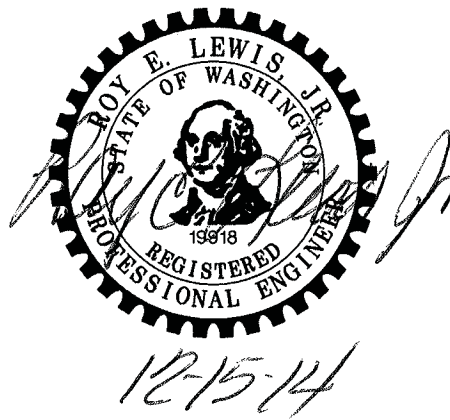


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LIST OF SUPPLEMENTAL INFORMATION

Note: Where applicable, supplemental information is located at the end of each section.

Section 1:

TIR WORKSHEET

Section 2:

CITY OF KIRKLAND FLOW CONTROL MAP

CITY OF KIRKLAND SURFACE WATER MASTER PLAN (REVIEWED, BUT NOT INCLUDED)

KIRKLAND'S STREAMS, WETLANDS AND WILDLIFE STUDY (REVIEWED, BUT NOT INCLUDED)

CITY OF BELLEVUE: YARROW CREEK BASIN DETAILS

Section 3:

OFFSITE ANALYSIS DRAINAGE SYSTEM TABLE

OFFSITE ANALYSIS EXHIBIT

NRCS SOIL SURVEY MAP AND LEGEND

FEMA FIRM MAP

CITY OF KIRKLAND SURFACE WATER MAPS

CITY OF KIRKLAND SENSITIVE AREAS MAP

Section 4:

EXISTING CONDITIONS EXHIBIT

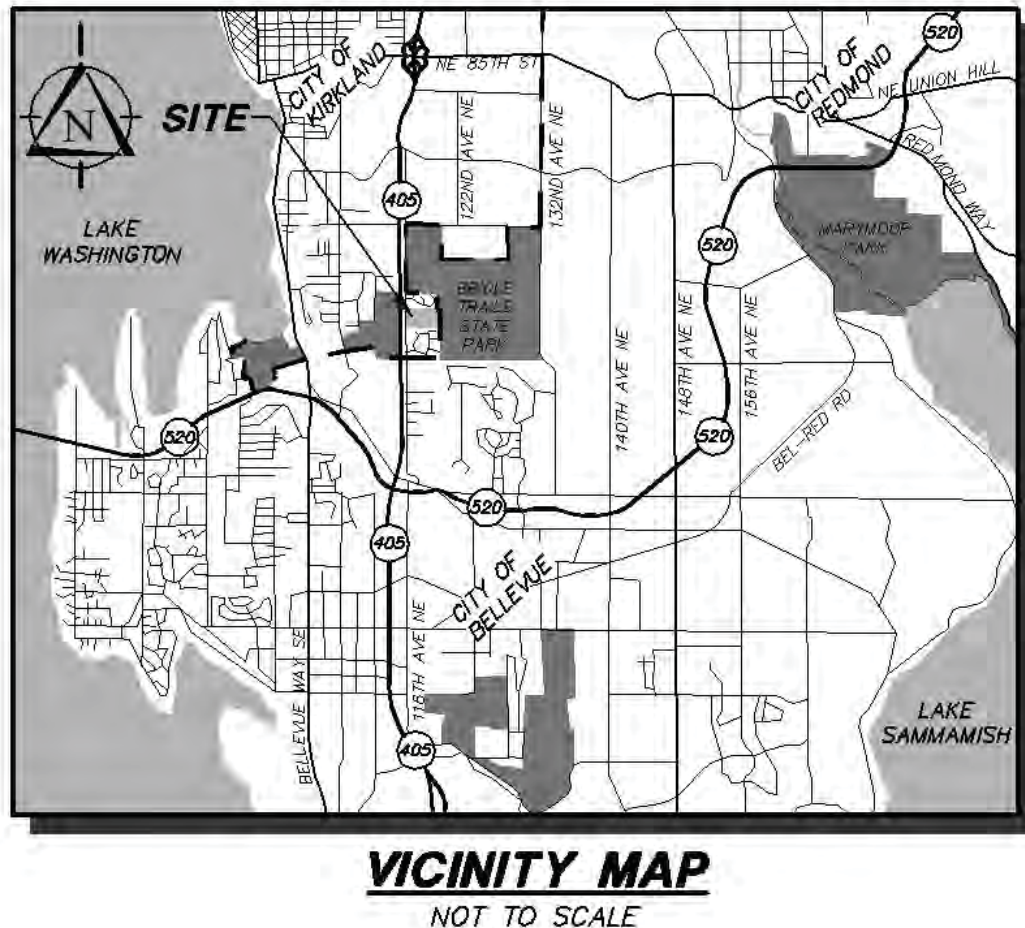
DEVELOPED CONDITIONS EXHIBIT

WWHM DOCUMENTATION

1 PROJECT OVERVIEW

The Bridlestone Estates Preliminary Plat (project) is a residential development that proposes to construct 35-single-family lots within the City of Kirkland. The project consists of 5 existing parcels, which are 162505-9017, -9021, -9022, -9031 and -9034. The total parcel area is 17.59 acres, of which 14.40 acres will be developed. The remaining 3.19 acres contain sensitive areas with associated buffers that will remain undeveloped. See the *Existing and Developed Conditions Exhibits* located at the end of Section 4 for reference.

The site is located near the 4600 block of 116th Avenue NE in Kirkland, WA. More generally, the site is located in the NW $\frac{1}{4}$, SW $\frac{1}{4}$ of Section 16, Township 25 North, Range 5 East, W.M., King County, Washington.



The Bridlestone Estates Preliminary Plat is a new development and is required to comply with the Minimum Requirements of the 2009 King County Surface Water Design Manual and the City of Kirkland Addendum to the 2009 King County Surface Water Design Manual (2009 KCSWDM). See Section 2 of this report for an outline of the Minimum Requirements and how they have been addressed for this project.

The existing site conditions consist of residential properties with two large equestrian arenas and training fields. Two existing access points from 116th Avenue NE serve these parcels. The eastern two-thirds of the site contain the majority of the existing improvements with several dense tree clusters. The western one-third of the site is primarily dense vegetation and contains sensitive areas. The site is surrounded to the west by 116th Avenue NE, to the east by Bridle Trails State Park and to the north and south by single-family developments.

Site topography slopes generally to the west with an average slope of 8%, with the steepest slopes ($\pm 33\%$) located along the eastern site boundary. Site underlying soils consist of Alderwood gravelly sandy loam, 6 to 15 percent slopes (AgC), Alderwood gravelly sandy loam, 15 to 30 percent slopes (AgD) and Norma Loam, per the NRCS Soil Survey Map. (See the end of Section 3 for a copy of the NRCS Soil Survey Map.) These three soils types are classified as Till Soils per 2009 KCSWDM Table 3.2.2.B. (See the end of Section 4 for a copy of this table.)

The site consists of one drainage basin which generally sheet flows to the west, towards the sensitive areas located along the 116th Avenue NE frontage. The stormwater flows that drain to these sensitive areas eventually enter the Yarrow Creek. The Yarrow Creek Basin is tributary to Lake Washington. (See Section 3 of this report for more details on the downstream flowpath.)

The developed site conditions propose to construct 35-single family residences with a new internal public access road from 116th Avenue NE. The existing southern access point will be improved to serve the project and the existing north access point will be removed. The

proposed internal public roadway will be within a 45-foot right-of-way, consisting of 26-feet of pavement, with vertical curb and gutter, 4-foot planters and 5-foot concrete sidewalks on both sides of the road. Other site improvements include water, sewer, dry utilities, and a stormwater facility. No frontage improvements are proposed or anticipated.

Surface water will be collected by the onsite storm conveyance system and routed to the combined stormwater detention/wetvault located in a Storm Tract in the western portion of the site. Stormwater modeling has been performed using the Western Washington Hydrologic Model 3 program (WWHM3). Section 1.2.3.2 of the City of Kirkland Addendum to the 2009 KCSWDM allows for the use of WWHM3 when sizing traditional stormwater facilities. Standard Flow Control will be met by the proposed detention portion of the combined detention/wetvault. For Standard Flow Control, stormwater discharges match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from the 50 percent of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition shall be matched to the fully-forested condition. The Basic Water Quality treatment standard will be met by the proposed wetvault portion of the combined detention/wetvault. See Section 4 - Flow Control and Water Quality Design for detailed calculations.

A small portion of the main access road from 116th Avenue NE will bypass the combined detention/wetvault due to topographical constraints. This bypass area has been accounted for in the stormwater detention facility sizing for flow control. The Basic Water Quality treatment standard for the bypass area will be met by the proposed continuous inflow bioswale located adjacent to the bypass area.

King County Department of Development and Environmental Services
TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

**Part 1 PROJECT OWNER AND
PROJECT ENGINEER**

Project Owner:

KLN Construction, Inc.

Address

19000 - 33rd Avenue W., Suite 200

Lynnwood, WA 98036

Phone:

(425) 778-4111

Project Engineer:

Roy E. Lewis, Jr., PE

Company: Triad

Address/Phone: 425-415-2000

**Part 2 PROJECT LOCATION AND
DESCRIPTION**

Project Name:

Bridlestone Estates

Location:

Township 25N

Range 05E

Section 16

**Part 3 TYPE OF PERMIT
APPLICATION**

☒ Subdivision

☐ Short Subdivision

☐ Grading

☐ Commercial

☐ Other _____

Part 4 OTHER REVIEWS AND PERMITS

☐ DFW HPA

☐ Shoreline

Management

☐ COE 404

☐ Rockery

☐ DOE Dam Safety

☒ Structural Vaults

☐ FEMA Floodplain

☐ Other

☐ COE Wetlands

Part 5 SITE COMMUNITY AND DRAINAGE BASIN

Community

Kirkland

Drainage Basin

Yarrow Creek

Part 6 SITE CHARACTERISTICS

- | | |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <input type="checkbox"/> River _____ | <input type="checkbox"/> Floodplain _____ |
| <input checked="" type="checkbox"/> Stream <u>Yarrow Creek located near frontage</u> | <input checked="" type="checkbox"/> Wetlands <u>Located along frontage</u> |
| <input type="checkbox"/> Critical Stream Reach | <input type="checkbox"/> Seeps/Springs |
| <input type="checkbox"/> Depressions/Swales | <input type="checkbox"/> High Groundwater Table |
| <input type="checkbox"/> Lake _____ | <input type="checkbox"/> Groundwater Recharge |
| <input type="checkbox"/> Steep Slopes _____ | <input type="checkbox"/> Other _____ |

Part 7 SOILS

Soil Type	Slopes	Erosion Potential	Erosive Velocities
<u>AgC</u>	<u>6-15%</u>	<u>Low</u>	<u>Low</u>
<u>AgD</u>	<u>15-30%</u>	<u>Low</u>	<u>Low</u>
<u>No</u>	<u>-</u>	<u>Low</u>	<u>Low</u>
_____	_____	_____	_____

☐ Additional Sheets Attached

Part 8 DEVELOPMENT LIMITATIONS

REFERENCE	LIMITATION / SITE CONSTRAINT
<input type="checkbox"/> <u>Ch. 4 – Downstream Analysis</u>	<u>N/A</u>
<input type="checkbox"/> _____	_____
<input type="checkbox"/> _____	_____
<input type="checkbox"/> _____	_____
<input type="checkbox"/> _____	_____
<input type="checkbox"/> _____	_____
<input type="checkbox"/> Additional Sheets Attached	

Part 9 ESC REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
<input checked="" type="checkbox"/> Sedimentation Facilities	<input checked="" type="checkbox"/> Stabilize Exposed Surface
<input checked="" type="checkbox"/> Stabilized Construction Entrance	<input checked="" type="checkbox"/> Remove and Restore Temporary ESC Facilities
<input checked="" type="checkbox"/> Perimeter Runoff Control	<input checked="" type="checkbox"/> Clean and Remove All Silt and Debris
<input checked="" type="checkbox"/> Clearing and Grading Restrictions	<input checked="" type="checkbox"/> Ensure Operation of Permanent Facilities
<input checked="" type="checkbox"/> Cover Practices	<input checked="" type="checkbox"/> Flag Limits of SAO and open space preservation areas
<input checked="" type="checkbox"/> Construction Sequence	<input type="checkbox"/> Other
<input type="checkbox"/> Other	

Part 10 SURFACE WATER SYSTEM

<input type="checkbox"/> Grass Lined Channel	<input type="checkbox"/> Tank	<input type="checkbox"/> Infiltration	Method of Analysis
<input checked="" type="checkbox"/> Pipe System	<input checked="" type="checkbox"/> Vault	<input type="checkbox"/> Depression	<u>WWHM3 - Standard.</u>
<input type="checkbox"/> Open Channel	<input checked="" type="checkbox"/> Energy Dissipater	<input type="checkbox"/> Flow Dispersal	<u>Flow Control</u>
<input type="checkbox"/> Dry Pond	<input type="checkbox"/> Wetland	<input type="checkbox"/> Waiver	Compensation /
<input type="checkbox"/> Wet Pond	<input type="checkbox"/> Stream	<input type="checkbox"/> Regional Detention	Mitigation of
			Eliminated Site
			Storage

Brief Description of System Operation A combined detention/wetvault is located onsite in the Stormwater Tract in the SW corner and have been designed to meet Standard Flow Control and Basic Water Quality per the 2009 KSWDM and City of Kirkland Addendum. The onsite conveyance system will collect and route site flows to the combined detention/ wetvault with a controlled release to the onsite wetlands along the 116th Avenue NE frontage.

Facility Related Site Limitations

Reference	Facility	Limitation
Flow Control	<u>Detention</u>	<u>Proposed Volume = 151,195 cubic-feet</u>
Water Quality	<u>Wetvault</u>	<u>Proposed Volume = 65,014 cubic-feet</u>

Part 11 STRUCTURAL ANALYSIS

- ☒ Cast in Place Vault
- ☒ Retaining Wall
- ☐ Rockery > 4' High
- ☐ Structural on Steep Slope
- ☐ Other

Part 12 EASEMENTS/TRACTS

- ☒ Drainage Easement
- ☒ Access Easement
- ☒ Native Growth Protection Easement
- ☐ Tract
- ☐ Other

Part 13 SIGNATURE OF PROFESSIONAL ENGINEER

I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attachments. To the best of my knowledge the information provided here is accurate.

Ray C. Lewis Jr. *12-15-14*

Signed/Date

2 CONDITIONS AND REQUIREMENTS SUMMARY

2.1 Core Requirements

2.1.1 Core Requirement #1: Discharge at the Natural Location

Runoff from the proposed developed conditions will discharge near the western site boundary, which maintains the natural discharge location for the site. Please refer to the Level 1 Downstream Analysis included in this report (Section 3) for a description of the existing drainage conditions of the site.

2.1.2 Core Requirement #2: Offsite Analysis

See the Level 1 Downstream Analysis in Section 3.

2.1.3 Core Requirement #3: Flow Control

This project is required to comply with the 2009 KCSWDM and the City of Kirkland Addendum to the 2009 KCSWDM for flow control. Section 1.2.3.2 of the City of Kirkland Addendum to the 2009 KCSWDM allows for the use of WWHM3 when sizing traditional stormwater facilities. Standard Flow Control will be met by the proposed detention portion of the combined detention/wetvault. See Section 4 for more information.

2.1.4 Core Requirement #4: Conveyance System

The proposed storm conveyance system for the project site will be addressed at the final engineering stage and shall comply with the 2009 KCSWDM as adopted by the City of Kirkland.

2.1.5 Core Requirement #5: Erosion and Sediment Control

The proposed erosion and sediment control BMP's shall be designed per the requirements and design standards of the 2009 KCSWDM as adopted by the City of Kirkland. See Section 8 for more information.

2.1.6 Core Requirement #6: Maintenance and Operations

The proposed stormwater facilities will be public and regularly maintained by the City of Kirkland. Recommended operations and maintenance standards per the 2009 KCSWDM as adopted by the City of Kirkland shall be provided at the final engineering stage.

2.1.7 Core Requirement #7: Financial Guarantees and Liability

To be addressed at the final engineering stage.

2.1.8 Core Requirement #8: Water Quality

This project is required to comply with the Basic Water Quality standard per the 2009 KCSWDM as adopted by the City of Kirkland. See Section 4 for more information.

2.2 Special Requirement #1: Other Adopted Area-Specific Requirements

2.2.1 Critical Drainage Areas

Not applicable.

2.2.2 Master Drainage Plan

The *City of Kirkland Surface Water Master Plan* was reviewed during the resource review and no special drainage requirements were applicable to this project. The applicable section of this plan has been included at the end of this section for reference.

2.2.3 Basin Plans

The site is located within the Yarrow Creek Basin, which is tributary to Lake Washington. Multiple Yarrow Creek Basin reports were reviewed and no special drainage requirements for future development within the basin were revealed during the resource review for the project. These reports include *Kirkland's Streams, Wetlands and Wildlife Study* (The Watershed Company) and the *Yarrow Creek Basin Details* (City of Bellevue), and have been included at the end of this section for reference.

2.2.4 Lake Management Plans

Not applicable.

2.2.5 Shared Facility Drainage Plans

Not applicable.

2.3 Special Requirement #2: Floodplain/Floodway Delineation

Not applicable. The project is not mapped as being within the limits of the 100-year floodplain.

2.4 Special Requirement #3: Flood Protection Facilities

Not applicable.

2.5 Special Requirement #4: Source Controls

Not applicable for single-family residential projects.

2.6 Special Requirement #5: Oil Control

Not applicable.

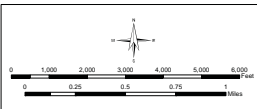
Flow Control Map

- Level 1/Potential Direct Discharge
- Level 2 Flow Control
- SW_Drainage_Basins
- 1/4 Section Grid
- Parks
- Schools
- Railroad
- Major Streets
- Streets
- City Limits
- Lakes

Level 1/Direct Discharge areas may be eligible for either Conveyance Protection (Level 1) flow control, or for the Direct Discharge Exemption, per the 1998 King County Surface Water Design Manual.

The information included on this map has been compiled from a variety of sources and is subject to change without notice.

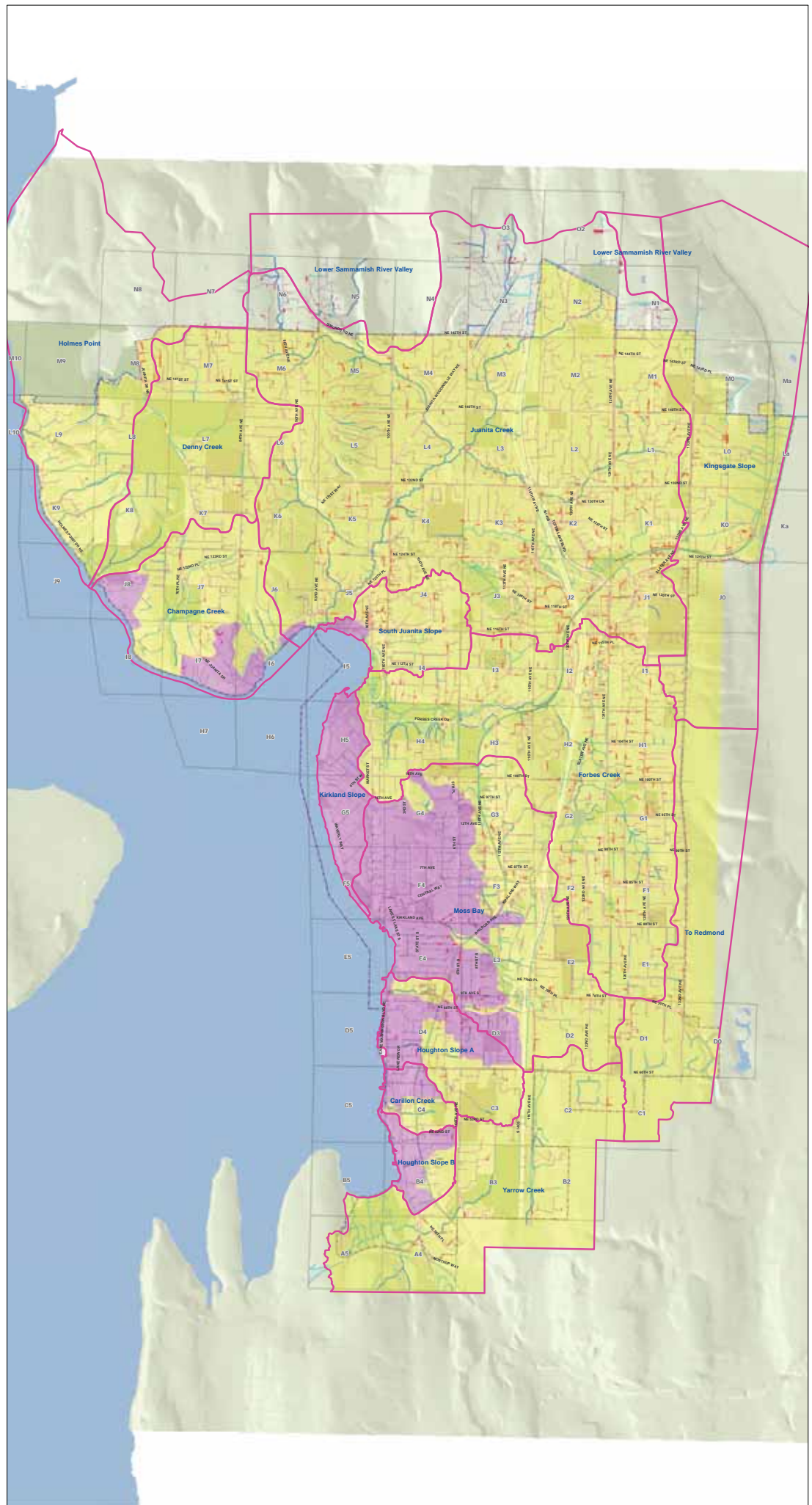
Flow Control Areas Last Reviewed May 2011



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No warranties of any sort, including but not limited to accuracy, fitness or merchantability, accompany this product.

Author:
Name: FlowControl_Map
Date Saved: 5/12/2011 2:53:03 PM

Path: M:\2010\Map\SurfaceWater\SurfaceWaterGroup\FlowControl\FlowControl_Map.mxd





Yarrow Creek Basin

Lake Washington Watershed (WRIA 8)
State Stream #08-0252

LAND CHARACTERISTICS

Basin Area: 1,667 Total Acres (5 % of the City)

Drainage Jurisdiction(s):

926.4 Acres - in Bellevue
0.8 Acres - in Clyde Hill
281.2 Acres - in King County
457.1 Acres - in Kirkland

Highest Elevation: 534 Ft

Lowest Elevation: 9 Ft

Total Length of Open Channel: 21,042 Ft

Total Length of Storm Drainage Pipes: 78,411 Ft

Built Rain Storage Volume per Acre of Impervious Surface:
Less than 0.5 Inches

POPULATION

City Basin Population (2000): 3,772 (3.4% of the City)

Basin Population Density: 1,911 People/Square Mile

Number 4 of 26 Basins (One is the lowest density)

LAND USE (within Bellevue city limits)

Public Right of Way:	16.49%	274.94 Acres
Commercial/Office:	10.23%	94.8 Acres
Industrial:	1.73%	16.0 Acres
Institutional/Government:	2.25%	20.9 Acres
Mixed Use/Misc:	5.49%	50.9 Acres
Multi-Family Residential:	6.87%	63.6 Acres
Open Space/Park:	2.52%	23.3 Acres
Single Family Residential:	39.36%	364.6 Acres

SALMON PRESENT in BASIN

Chinook*+ (Lake only)

Rainbow trout (Lake only)

Coho+ (Lake only)

Sockeye (Lake only)

Cutthroat trout

Steelhead (Lake only)

* Listed Federal Endangered Species

+ City Species of Local Importance (Bellevue Land Use Code 20.25H.150A)

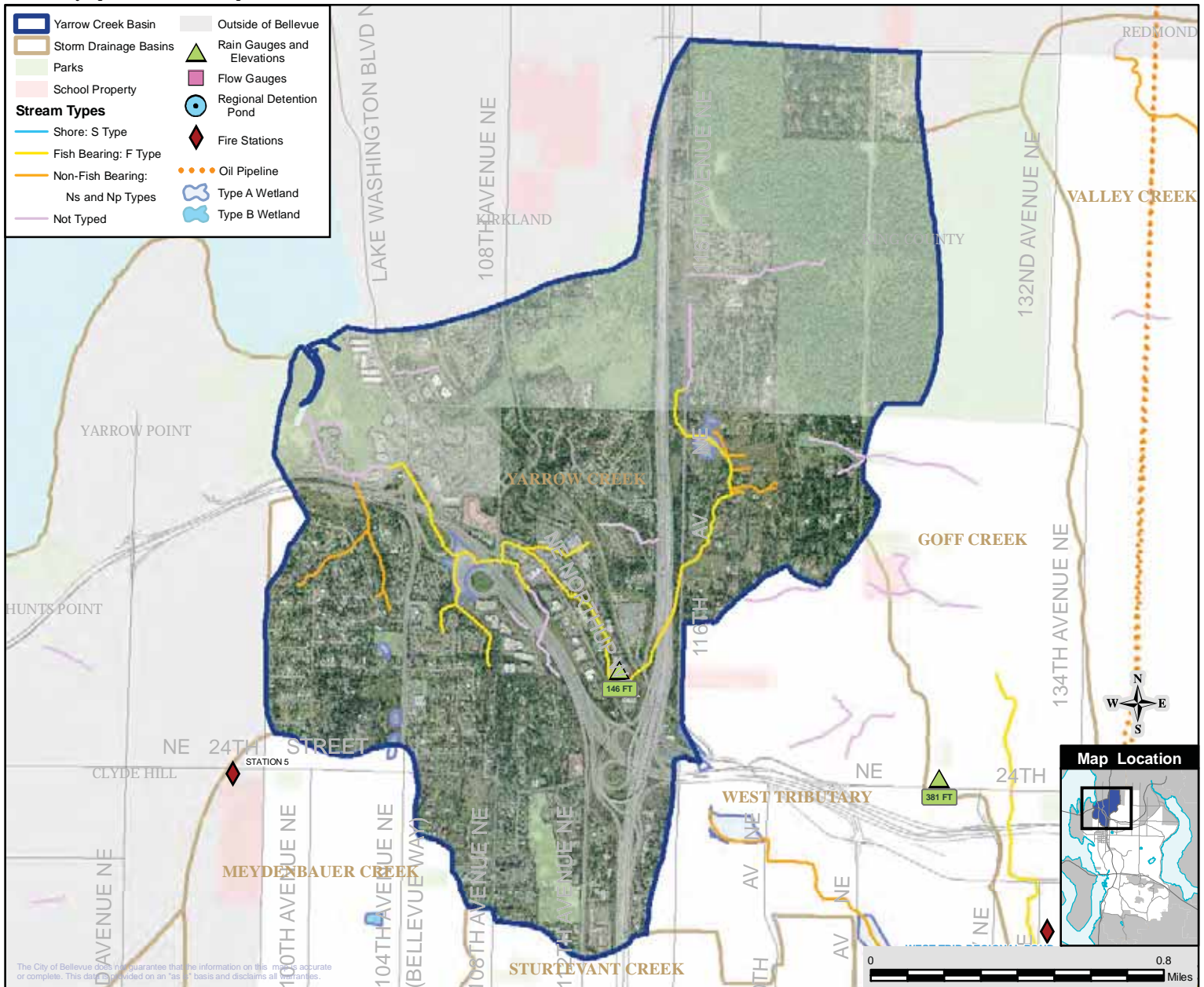
LAND COVER

Impervious: 31%

Tree Canopy: 53%

Impervious in 100 Ft Stream Buffer: 27%

Tree Canopy in 100 Ft Stream Buffer: 58%



3 OFFSITE ANALYSIS

An Offsite Analysis was performed based on the requirements of the 2009 KCSWDM as adopted by the City of Kirkland. An *Offsite Analysis Exhibit*, which summarizes the downstream drainage components for one-quarter mile flowpath has been included at the end of this section to aid in this discussion.

3.1 RESOURCES USED FOR ANALYSIS

Available existing resources were researched for the one-mile downstream flowpath from the site and all the relevant information revealed in this review has been summarized below.

3.1.1 Adopted Basin Plan

The site is located in the Yarrow Creek Basin which is tributary to Lake Washington. The Yarrow Creek Basin is shown on the *City of Kirkland Flow Control Map* located at the end of this section for reference.

3.1.2 Critical Drainage Areas Map

The site is located within the City of Kirkland that requires Level 2 Flow Control per the 2009 KCSWDM. A copy of the *City of Kirkland Flow Control Map* has been included at the end of this section for reference.

3.1.3 Flood Plain / Floodway Map

The site is not located on or near the 100-year floodplain per the *FEMA Firm Map*. A copy of this map has been included at the end of this section for reference.

3.1.4 Sensitive Areas Folio

The site has sensitive areas located along the western site boundary. The sensitive areas consist of a wetland and Yarrow Creek. These areas will remain undeveloped. A Critical Areas Report has been prepared for this project and will be submitted as a separate document.

3.1.5 Soil Survey

The soils on the site consist of Alderwood type 'C'. A copy of the *NRCS Soils Map* has been included at the end of this section for reference.

3.1.6 Drainage Complaints - City of Kirkland

Drainage complaints were requested from the City of Kirkland for the portion of the one-mile downstream flowpath that is within the city limits of Kirkland. No drainage complaints were identified.

3.1.7 Drainage Complaints - City of Bellevue

Drainage complaints were requested from the City of Bellevue for the portion of the one-mile downstream flowpath that is within the city limits of Bellevue. No drainage complaints were identified.

3.2 FIELD RECONNAISSANCE

A field reconnaissance was conducted on November 20, 2013. Weather conditions consisted of clear skies with temperatures in the lower 40's. The downstream flowpath was observed for one-quarter mile. As mentioned in the Project Overview, the site contributes to Yarrow Creek, which is tributary to Lake Washington.

3.3 UPSTREAM DRAINAGE ANALYSIS

An upstream tributary basin analysis was performed using King County iMap topography. The upstream forested area (Bridle Trails State Park) is directly east of the site and approximately 14.70-acres naturally sheet flows across the site. This upstream basin will be collected along the eastern site boundary and routed through the onsite combined detention/wetvault facility. Section 1.2.3.2.F of the 2009 KCSWDM states that "if the existing 100-year peak flow rate from any upstream area (not targeted for mitigation) is greater than 50% of the 100-year developed peak flow rate (undetained) for the area that must be mitigated, then the runoff from the upstream area must bypass the facility." This

14.7-acre upstream basin does not exceed this limitation and therefore will be routed through the onsite stormwater facility. See Section 4 of this report for detailed information.

3.4 DOWNSTREAM DRAINAGE ANALYSIS

An *Offsite Analysis Exhibit* has been included at the end of this section to aid in the discussion of the downstream runoff components presented below. When access to individual drainage components was limited due no trespassing signs on private property or dense vegetation, King County iMap topography and City of Kirkland Surface Water Maps were consulted.

Component A ~ Yarrow Creek (0' - 975')

Runoff from the site generally sheet flows to western portion of the site where sensitive areas are located. This runoff eventually outlets from the sensitive areas and enters Yarrow Creek. Yarrow Creek is located near the SW corner of the site and flows to the south. The creek continues to flow south between the eastern margin of 116th Avenue NE and the backyards of adjacent residential lots. The width of the creek varies from 1- to 4-feet with a varying depth of 0.5- to 1.5-feet. The slope for this drainage component is approximately 2%. Surrounding vegetation was well established and consisted of mature trees and infrequently mowed grass. Access was limited for portions of this drainage component due to the creek's location on private property with fence lines. No signs of erosion or flooding were observed at the time of the site visit.

Component B ~ 24" Pipe and Catch Basin System (975' - 1,025')

Runoff from Component 'A' enters a 24" pipe inlet near the intersection of 116th Avenue NE and NE 41st Street. This runoff is directed to the west under 116th Avenue NE. The slope for this drainage component is approximately 2% and discharges to a rock pad near the western margin of 116th Avenue NE. Minor sediment accumulation was observed on the outlet rock pad. No signs of flooding were observed at the time of the site visit.

Component C ~ Yarrow Creek (1,025' - 1,320'+)

Runoff from Component 'B' flows in the generally to the southwest across the heavily forested portion of the Interstate 405 right-of-way. Access to this drainage component was limited due to surrounding dense vegetation. The slope for this drainage component is approximately 5%. As noted in the description of Component 'B', minor sediment accumulation was observed at the start of this drainage component. No signs of flooding were observed at the time of the site visit. This drainage component directs the site runoff beyond the one-quarter mile downstream point.

3.5 SUMMARY

This analysis did not reveal any documented or observed downstream problems that would require additional stormwater mitigation as defined by the 2009 KCSWDM as adopted by the City of Kirkland. The development impacts for the projects will be mitigated by providing onsite flow control (Standard Flow Control), which is intended to produce lower peak storm events flows spread over a longer time period.

OFFSITE ANALYSIS DRAINAGE SYSTEM TABLE

SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Lake Washington

Subbasin Name: Yarrow Creek

Subbasin Number:

Drainage Component Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Average Slope	Distance from site discharge	Existing Problems	Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: sheet flow, Swale, stream, channel, pipe, pond; Size: diameter, surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	' / ml = 1,320 ft.	constrictions, under capacity, ponding, overtopping, flooding, habitat destruction, scouring, bank sloughing, sedimentation, incision, other erosion	capacity, ponding, habitat or organism	tributary area, likelihood of problem, overflow pathways, potential impacts
A	Yarrow Creek	Site runoff will have a controlled release to Yarrow Creek near the SW corner of the site. The width of the creek varies from 1- to 4-feet wide with a varying depth of 0.5- to 1.5-feet. The creek flows to the south along the eastern margin of 116th Avenue NE and has an approximate slope of 2%. Surrounding vegetation of the creek was well established and consisted of trees and infrequently mowed grass. Access to portions of the creek were limited due to it being located on private properties and private fences.	±2%	0' to 975'	No signs of erosion or flooding were observed in the creek or at the end of this drainage component..	The creek channel appears to have sufficient capacity. Site development would produce lower peak flows in the creek, spread over a longer time period.	Overflow pathway would be along the shoulder of 116th Avenue NE until it reaches Drainage Component 'B'. With regular maintenance, the likelihood of a problem is minimal.
B	24" pipe and CB system.	Yarrow Creek enters a 24" pipe and CB system located in the NE intersection corner of NE 41st Street and 116th Avenue NE. This drainage component directs runoff to the west under 116th Avenue NE. The catch basin structures are located in pavement. There appeared to be at least 4-feet of cover over the pipes. This drainage component has an approximate slope of 2%. Flows in this component were approximately 0.5-feet deep at the time of the site visit.	±2%	975' to 1,025'	No signs of erosion or flooding were observed at the inlet and outlet of this drainage component.	The 24" pipes appear to have sufficient capacity. Site development would produce lower peak flows in the pipe and catch basin system, spread over a longer time period.	Overflow pathway would be across 116th Avenue NE.. With regular maintenance, the likelihood of a problem is minimal.

[illegible]

PROJECT SITE

PROJECT DISCHARGE LOCATION

PROJECT DOWNSTREAM FLOWPATHS (TYP)

1/2-1/4 MI PT



SCALE: 1" = 200'

MAP SOURCE:
2013 CITY OF KIRKLAND
SURFACE WATER MAP



SITE TALKING: 800-
 800-800-8000
 800-800-8000
 800-800-8000
 800-800-8000

OFFSITE ANALYSTS EXHIBIT

KLW CONSTRUCTION, INC.
BRIDGESTONE ESTATES

1000

DATE OF ORDER

[illegible]

WINTER FUEL TIPS
WATER, SMOKE AND MORE

13-097

100

© 2013 TRIAD ASSOCIATES


Soil Map—King County Area, Washington
(Bridlestone Estates - Soil Map)



Soil Map—King County Area, Washington
(Bridlestone Estates - Soil Map)

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 10, Sep 30, 2014

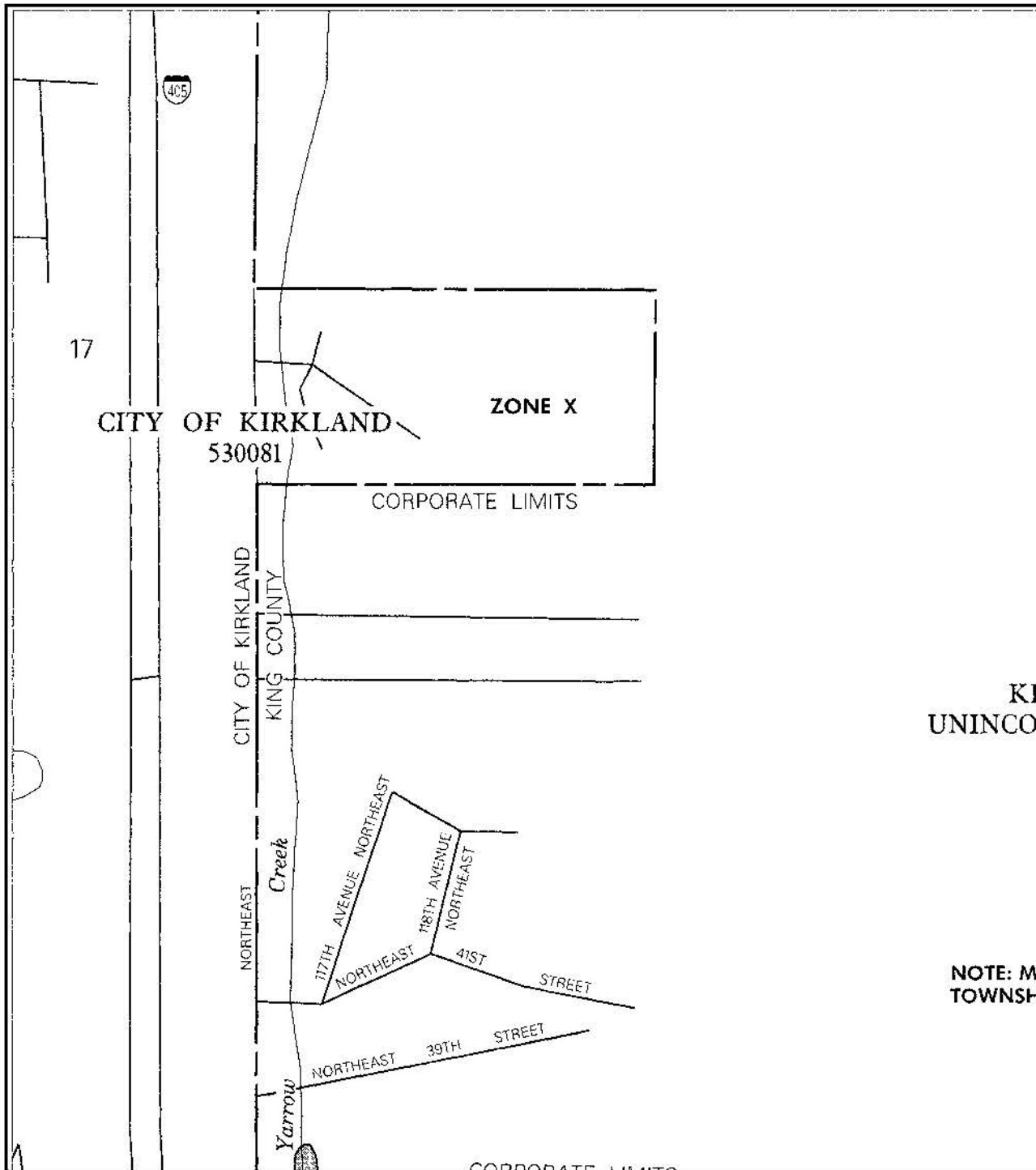
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

King County Area, Washington (WA633)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	15.0	86.7%
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes	1.5	8.5%
No	Norma sandy loam	0.8	4.8%
Totals for Area of Interest		17.3	100.0%



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

KING COUNTY,
WASHINGTON AND
INCORPORATED AREAS

PANEL 368 OF 1725

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
BELLEVUE CITY OF	530674	0368	F
KING COUNTY	530671	0368	F
UNINCORPORATED AREAS	530681	0368	F
KIRKLAND CITY OF			

MAP NUMBER
53033C0368 F

MAP REVISED:
MAY 16, 1995



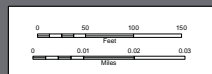
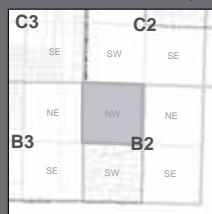
Federal Emergency Management Agency

KI
UNINCOR

NOTE: MA
TOWNSHI

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

- Surface Water Nodes**
- Catch Basin (Type I/III)
 - Catch Basin (Type II)
 - Catch Basin (Other)
 - Catch Basin, Storm Filter - 1
 - Catch Basin, Storm Filter - 2
 - Catch Basin, Storm Filter - 3
 - Catch Basin, Storm Filter - 4
 - Catch Basin, Storm Filter - 5
 - Blind Tee
 - Cleanout
 - Dead End
 - Inlet
 - Material Change
 - Other
 - Outfall
 - Riser
 - Sewer Connection
- Surface Water Nodes (Detention)**
- Catch Basin (Type I/III)
 - Catch Basin (Type II)
 - Catch Basin (Other)
 - Catch Basin, Storm Filter - 1
 - Catch Basin, Storm Filter - 2
 - Catch Basin, Storm Filter - 3
 - Catch Basin, Storm Filter - 4
 - Blind Tee
 - Cleanout
 - Dead End
 - Inlet
 - Material Change
 - Other
 - Outfall
 - Riser
- Surface Water Nodes (Control)**
- Catch Basin (Type I Control)
 - Catch Basin (Type II Control)
 - Catch Basin (Type II Control)
 - Catch Basin (Type II Control)
 - Other (Control)
 - Other (Control)
- Surface Water Features**
- Culvert
 - Pipe
 - Trench Drain
 - Tank
 - Ditch
 - Stream
 - Swale
 - Culvert (Private)
 - Pipe (Private)
 - Trench Drain (Private)
 - Tank (Private)
 - Ditch (Private)
 - Stream (Private)
 - Swale (Private)
 - Vault
 - Pond
 - Sensitive Area*
 - Ac Build Tag Number
 - Tax Parcel
 - Park/Open Space
 - School
 - 10-Foot Contour
 - 1/4 1/4 Section Grid
 - City Limit Boundary
- * Surface water features that have been tagged by the Planning Department as a sensitive area feature (shown as pipe background)



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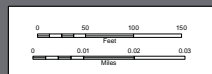
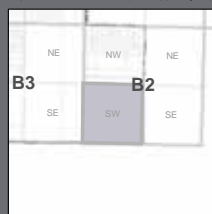
Author: onast
 Name: StormMapBook.2013.Pages
 Path: M:\SurfaceWaterMapBook\2013\StormMapBook.2013.Pages.mxd
 Date Saved: 3/12/2013 11:00:21 AM



- AC: Asbestos Cement
- ASP: Aluminum Spiral Rib
- CAP: Cast-in-place Concrete
- CONC: Plain Concrete
- CPE: Cast-in-place Polyethylene
- DI: Ductile Iron
- GCP: Galvanized Corrugated Polyethylene
- GCBT: Galvanized Steel Spiral Rib
- LCP: Lead Corrugated Polyethylene
- NA: NA
- PVC: Polyvinyl Chloride
- RCP: Reinforced Concrete
- SWPE: Solid Well Polyethylene

B2-NW

- Surface Water Nodes**
- Catch Basin (Type I/Inlet)
 - Catch Basin (Type II)
 - Catch Basin (Other)
 - Catch Basin, Storm Filter - 1
 - Catch Basin, Storm Filter - 2
 - Catch Basin, Storm Filter - 3
 - Catch Basin, Storm Filter - 4
 - Catch Basin, Storm Filter - 5
 - Blind Tee
 - Cleanout
 - Dead End
 - Inlet
 - Material Change
 - Other
 - Outfall
 - Riser
 - Sewer Connection
- Surface Water Nodes (Detention)**
- Catch Basin (Type I/Inlet)
 - Catch Basin (Type II)
 - Catch Basin (Other)
 - Catch Basin, Storm Filter - 1
 - Catch Basin, Storm Filter - 2
 - Catch Basin, Storm Filter - 4
 - Blind Tee
 - Cleanout
 - Dead End
 - Inlet
 - Material Change
 - Other
 - Outfall
 - Riser
- Surface Water Nodes (Control)**
- Catch Basin (Type I Control)
 - Catch Basin (Type II O/Water)
 - Catch Basin (Type II Control)
 - Catch Basin (Type II O/Water)
 - Other (Control)
 - Other (O/Water)
- Surface Water Features**
- Culvert
 - Pipe
 - Trench Drain
 - Tank
 - Ditch
 - Stream
 - Swale
 - Culvert (Private)
 - Pipe (Private)
 - Trench Drain (Private)
 - Tank (Private)
 - Ditch (Private)
 - Stream (Private)
 - Swale (Private)
 - Vault
 - Pond
 - Sensitive Area*
 - Ac Build Tag Number
 - Tax Parcel
 - Park/Open Space
 - School
 - 10-Foot Contour
 - 1/4 1/4 Section Grid
 - City Limit Boundary
- * Surface water features that have been tagged by the Planning Department as a sensitive area feature (shown as pipe background)



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Surface Water Nodes

- Catch Basin (Type I/Init)
- Catch Basin (Type II)
- Catch Basin (Other)
- Catch Basin, Storm Filter - 1
- Catch Basin, Storm Filter - 2
- Catch Basin, Storm Filter - 3
- Catch Basin, Storm Filter - 4
- Catch Basin, Storm Filter - 5
- Blind Tee
- Cleanout
- Dead End
- Inlet
- Material Change
- Other
- Outfall
- Riser
- Sewer Connection

Surface Water Nodes (Detention)

- Catch Basin (Type I/Init)
- Catch Basin (Type II)
- Catch Basin (Other)
- Catch Basin, Storm Filter - 1
- Catch Basin, Storm Filter - 2
- Catch Basin, Storm Filter - 4
- Blind Tee
- Cleanout
- Dead End
- Inlet
- Material Change
- Other
- Outfall
- Riser

Surface Water Nodes (Control)

- Catch Basin (Type I Control)
- Catch Basin (Type I Oil/Water)
- Catch Basin (Type II Control)
- Catch Basin (Type II Oil/Water)
- Other (Control)
- Other (Oil/Water)

Other Features

- Culvert
- Pipe
- Trench Drain
- Tank
- Ditch
- Stream
- Swale
- Culvert (Private)
- Pipe (Private)
- Trench Drain (Private)
- Tank (Private)
- Ditch (Private)
- Stream (Private)
- Swale (Private)
- Vault
- Pond
- Sensitive Area*
- Ac Build Tag Number
- Tax Parcel
- Park/Open Space
- School
- 10-Foot Contour
- City Limit Boundary

* Surface water features that have been tagged by the Planning Department as a sensitive area feature (shown as pipe background)

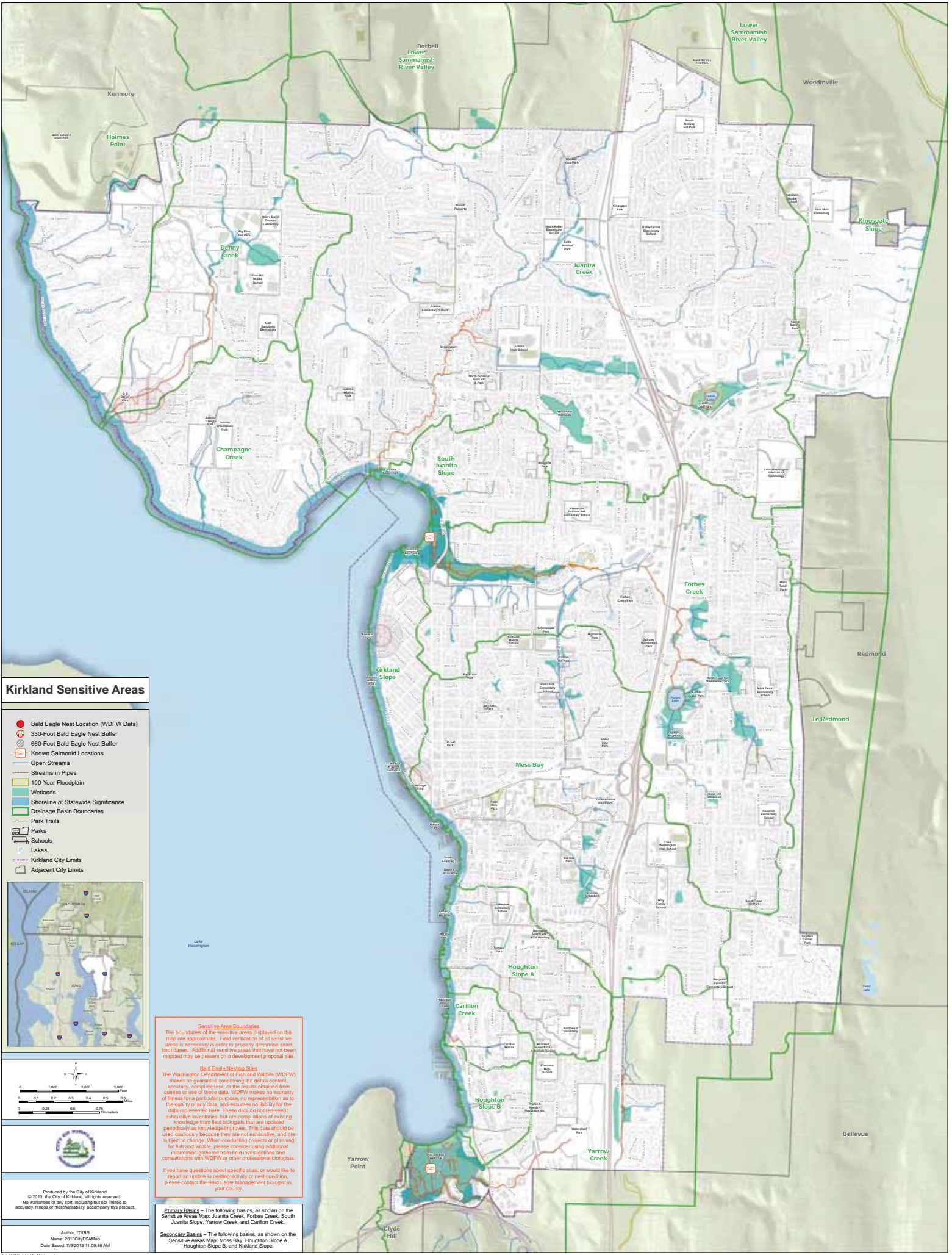


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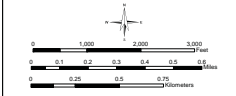


B3-SE



Kirkland Sensitive Areas

- Bald Eagle Nest Location (WDFW Data)
- 330-Foot Bald Eagle Nest Buffer
- 660-Foot Bald Eagle Nest Buffer
- Known Salmonid Locations
- Open Streams
- Streams in Pipes
- 100-Year Floodplain
- Wetlands
- Shoreline of Statewide Significance
- Drainage Basin Boundaries
- Park Trails
- Parks
- Schools
- Lakes
- Kirkland City Limits
- Adjacent City Limits



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Author: ITGIS
Name: 2013CityESAMap
Date Saved: 7/9/2013 11:09:16 AM

Sensitive Area Boundaries
The boundaries of the sensitive areas displayed on this map are approximate. Field verification of all sensitive areas is necessary in order to properly determine exact boundaries. Additional sensitive areas that have not been mapped may be present on a development proposal site.

Bald Eagle Nesting Sites
The Washington Department of Fish and Wildlife (WDFW) makes no guarantee concerning the data's content, accuracy, completeness, or the results obtained from queries or use of these data. WDFW makes no warranty of fitness for a particular purpose, no representation as to the quality of any data, and assumes no liability for the data represented here. These data do not represent exhaustive inventories, but are compilations of existing knowledge from field biologists that are updated periodically as knowledge improves. This data should be used cautiously because they are not exhaustive, and are subject to change. When conducting projects or planning for fish and wildlife, please consider using additional information gathered from field investigations and consultations with WDFW or other professional biologists.

If you have questions about specific sites, or would like to report an update in nesting activity or nest condition, please contact the Bald Eagle Management biologist in your county.

Primary Basins – The following basins, as shown on the Sensitive Areas Map: Juanita Creek, Forbes Creek, South Juanita Slope, Yarrow Creek, and Carillon Creek

Secondary Basins – The following basins, as shown on the Sensitive Areas Map: Moss Bay, Houghton Slope A, Houghton Slope B, and Kirkland Slope.

4 FLOW CONTROL AND WATER QUALITY DESIGN

4.1 Performance Standards

The following Flow Control and Water Quality treatment standards apply to this project.

- **Standard Flow Control:** Stormwater discharges match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from the 50 percent of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition shall be matched to the fully-forested condition. Section 1.2.3.2 of the City of Kirkland Addendum to the 2009 KCSWDM allows for the use of WWHM3 when sizing traditional stormwater facilities.
- **Basic Water Quality:** The Water Quality Volume has been sized using the 6-month, 24-hour runoff volume, as estimated by WWHM3. Again, Section 1.2.3.2 of the City of Kirkland Addendum to the 2009 KCSWDM allows for the use of WWHM3 when sizing traditional stormwater facilities.

4.2 Flow Control Basin Modeling

4.2.1 Existing Conditions

See the *Existing Conditions Exhibit* located at the end of this section to aid in this discussion. As discussed in the Project Overview, the existing site conditions consist of several residential properties with two large equestrian arenas and training fields. These properties total 17.59 acres, of which 14.40 acres will be developed.

The site consists of one drainage basin which generally sheet flows to the western portion of the site where sensitive areas are located. This runoff eventually outlets from the sensitive areas and enters Yarrow Creek. Yarrow Creek is located near the SW corner of the site and flows to the south. See Section 3 of this report for more details on the downstream flowpath.

The eastern two-thirds of the site contain the majority of the existing improvements with several tree clusters. The western one-third of the site is primarily dense vegetation and contains sensitive areas (wetlands). Site topography slopes generally to the west with an average slope of 8%, with the steepest slopes located along the eastern site boundary. Site underlying soils consist of Alderwood gravelly sandy loam, 6 to 15 percent slopes (AgC), Alderwood gravelly sandy loam, 15 to 30 percent slopes (AgD) and Norma Loam per the NRCS Soil Survey Map.

For stormwater modeling using WWHM3, the existing site conditions were assumed to be fully-forested, taking no credit for the existing impervious areas. The existing conditions were modeled as shown below:

Existing Conditions

Existing Site Basin	= 14.40 acres - Forest, Moderate Slopes
<u>Upstream Basin (non-targeted surface)</u>	<u>= 14.70 acres - Forest, Moderate Slopes</u>
Total Area =	= 29.10 acres

4.2.2 Developed Conditions

See the *Developed Conditions Exhibit* located at the end of this section to aid in this discussion. The developed site conditions propose to construct 35-single family residences with a new internal public access road from 116th Avenue NE. The existing southern access point will be improved to serve the internal public access road. The existing north access point will be removed. This proposed road will be within a 45-foot right-of-way, consisting of 26-feet of pavement with vertical curb and gutter, a 4-foot planters and 5-foot concrete sidewalks on both sides of the road. Other site improvements include water, sewer, dry utilities and a combined detention/wetvault facility for stormwater mitigation. No frontage improvements are proposed or anticipated.

Surface water will be collected by the onsite storm conveyance system and routed to the combined detention/wetvault located near the western site boundary. The detention portion of the combined detention/wetvault has been sized to comply with the Standard Flow Control per the 2009 KCSWDM as adopted by the City of Kirkland. A small portion of the developed conditions (entry roadway) will bypass the combined stormwater detention/wetvault due to topographical constraints. The Flow Control portion of the bypass area has been accounted for in the stormwater detention facility sizing.

For stormwater modeling using WWHM3, a maximum lot impervious coverage of 35% was used for each lot. In addition, a 700 sf driveway and 100 sf patio were modeled for each lot. The developed conditions were modeled as shown below and on the following page.

Developed Site Basin

Roof Tops	= 4.88 acres
Roads, Moderate Slopes	= 1.50 acres
Lawn, Moderate Slopes	= 7.02 acres
<u>Upstream Basin (non-targeted surface)</u>	<u>= 14.70 acres - Forest, Moderate Slopes</u>
Total Area =	= 28.10 acres

Developed Bypass Basin

Roof Tops	= 0.16 acres
Roads, Moderate Slopes	= 0.35 acres
<u>Lawn, Moderate Slopes</u>	<u>= 0.49 acres</u>
Total Area =	= 1.00 acres

4.2.3 Upstream Basin

As stated in Section 3 of this report, approximately 14.70-acres of upstream area (Bridle Trails State Park) naturally sheet flows across the site. These flows are proposed to be collected along the eastern site boundary and routed through the onsite stormwater facility. Section 1.2.3.2.F of the 2009 KCSWDM states that “if the existing 100-year peak flow rate from any upstream area (not targeted for mitigation) is greater than 50% of the 100-year developed peak flow rate (undetained) for the area that must be mitigated, then the runoff from the upstream area must bypass the facility.”

Upstream Basin

Pervious = 14.70 acres - modeled as Till-Forest

The Upstream Basin yields the following peak flows:

Flow Frequency Analysis									
Time Series File: upstream basin.tsf									
Project Location: Sea-Tac									
---Annual Peak Flow Rates---					----Flow Frequency Analysis-----				
Flow Rate	Rank	Time of Peak			-- Peaks --	Rank	Return	Prob	
(CFS)					(CFS)	Period			
0.927	2	2/09/01	18:00		1.19	1	100.00	0.990	
0.252	7	1/06/02	3:00		0.927	2	25.00	0.960	
0.687	4	2/28/03	3:00		0.712	3	10.00	0.900	
0.025	8	3/24/04	20:00		0.687	4	5.00	0.800	
0.408	6	1/05/05	8:00		0.600	5	3.00	0.667	
0.712	3	1/18/06	21:00		0.408	6	2.00	0.500	
0.600	5	11/24/06	4:00		0.252	7	1.30	0.231	
1.19	1	1/09/08	9:00		0.025	8	1.10	0.091	
Computed Peaks					1.10		50.00	0.980	

Developed Site & Bypass Basins

Pervious = 7.51 acres - modeled as Till-Grass

Impervious = 6.89 acres - modeled as Impervious

Total Developed Area = 14.41 acres

The Developed Area (undetained) yields the following peak flows:

Flow Frequency Analysis							
Time Series File: developed area.tsf							
Project Location: Sea-Tac							
---Annual Peak Flow Rates---				-----Flow Frequency Analysis-----			
Flow Rate	Rank	Time of Peak		-- Peaks --	Rank	Return	Prob
(CFS)				(CFS)	Period		
2.34	5	2/09/01	2:00	4.84	1	100.00	0.990
1.82	8	1/05/02	16:00	2.83	2	25.00	0.960
2.83	2	2/27/03	7:00	2.70	3	10.00	0.900
1.86	7	8/26/04	2:00	2.47	4	5.00	0.800
2.26	6	10/28/04	16:00	2.34	5	3.00	0.667
2.47	4	1/18/06	16:00	2.26	6	2.00	0.500
2.70	3	10/26/06	0:00	1.86	7	1.30	0.231
4.84	1	1/09/08	6:00	1.82	8	1.10	0.091
Computed Peaks				4.17	50.00	0.980	

From the data above, the Upstream Basin has a 100-year peak flow of 1.19 cfs, which is less than 50% of the Developed Area 100-year peak of 4.84 cfs. Therefore, the Upstream Basin is allowed to be routed through the site per the Section 1.2.3.2.F of the 2009 KCSWDM.

4.3 Detention Facility Analysis

Using WWHM3 and the above basin areas, the detention portion of the combined detention/wetvault (live storage) has been sized for the project per the 2009 KCSWDM and the City of Kirkland Addendum to the 2009 KCSWDM.

WWHM3 modeling resulted in a required detention volume of 144,060 cubic-feet using a live storage depth of 15-feet. A factor of safety (not a code requirement) has been added to the required volume in order to account for internal walls and constructability. This results in a proposed detention volume of 151,195 cubic-feet, with internal dimensions of 93.33-feet by 108-feet using a live storage depth of 15-feet.

Required Detention Volume = 144,060 cubic-feet

Proposed Detention Volume = 151,195 cubic-feet

The control structure consists of three orifices. The 1st Orifice is located at the bottom of the riser and is 2.19-inches in diameter. The 2nd Orifice is located 10-feet above the outlet elevation and is 3.63-inches in diameter. The 3rd Orifice is located 11.25-feet above the outlet elevation and is 2.06-inches in diameter. WWHM documentation for the detention modeling has been provided at the end of this section for reference.

4.4 Water Quality

As noted in Section 4.2.2, the developed conditions result in a Developed Site Basin and a Developed Bypass Basin. Both basins will provide Basic Water Quality treatment per the 2009 KCSWDM as adopted by the City of Kirkland.

For the Developed Site Basin, the Basic Water Quality treatment standard will be met by the proposed wetvault volume of the combined detention/wetvault. The required wetvault volume using the 6-month, 24-hour runoff volume estimated by WWHM is 1.4166 acre-feet (61,707 cubic-feet) of dead storage. A factor of safety (not a code requirement) has been added to the required volume in order to account for internal walls and constructability. This results in a proposed wetvault volume of 65,014 cubic-feet with a dead storage depth of 6.45-feet.

Required Wetvault Volume = 61,707 cubic-feet

Proposed Wetvault Volume = 65,014 cubic-feet

For the Developed Bypass Basin, the Basic Water Quality treatment standard will be met by the proposed continuous inflow bioswale located adjacent to main access roadway. The bioswale has been sized per Section 6.3.3 of the 2009 KCSWDM. This results in an adjacent roadside bioswale with a bottom width of 2.3-feet, 3:1 side slopes, a design water depth of 0.25-feet with 0.50-feet of freeboard and a longitudinal slope of 2.5%. However, the main access road centerline profile is approximately 8.5% for the majority of the Developed Bypass Basin. This required the proposed bioswale will have 1-foot steps in order to maintain gravity inflow into the facility. The proposed bioswale will outlet to the adjacent sensitive areas located along the 116th Avenue NE frontage.

4.5 Overflow Measures

Combined Stormwater Detention/Wetvault Overflow Riser

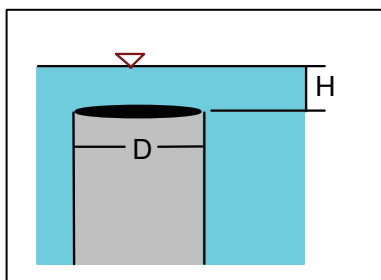
In the event that the orifices on the control structure should fail, the emergency overflow can convey the 100-year flow to the proposed discharge route. The riser will pass the undetained developed 100 year event (4.89 cfs) and a maximum of 0.5-foot of head.

$$Q = 9.739 D H^{3/2} \rightarrow H = \frac{(0.2193 * Q^{2/3})}{D^{2/3}}$$

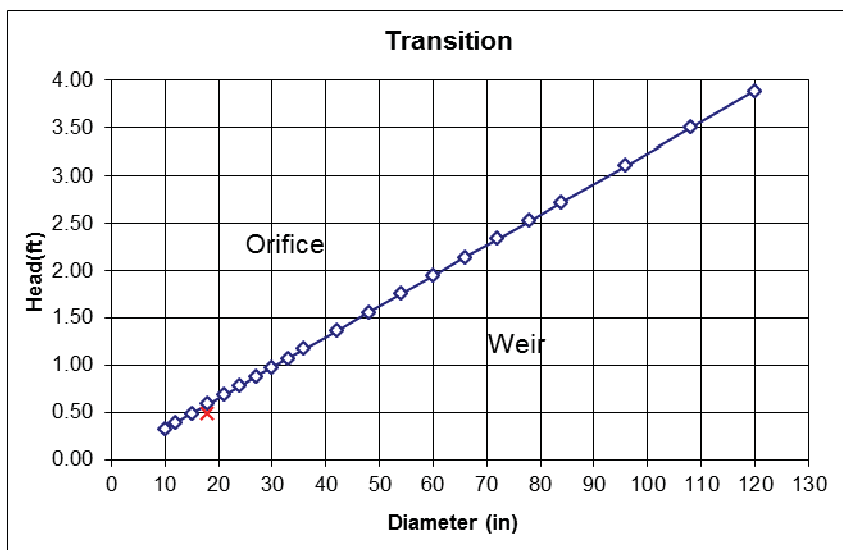
Where D = diameter (1.5 feet)

Q = flow (4.89 cfs)

$$H = \frac{(0.2193 * 4.89^{2/3})}{1.5^{2/3}} = 0.48 \text{ feet}$$



	Input	Output
Q (cfs)	4.89	4.89
D (in)	18	18.00
H (ft)	0.00	0.48
Flow:	Weir Flow	

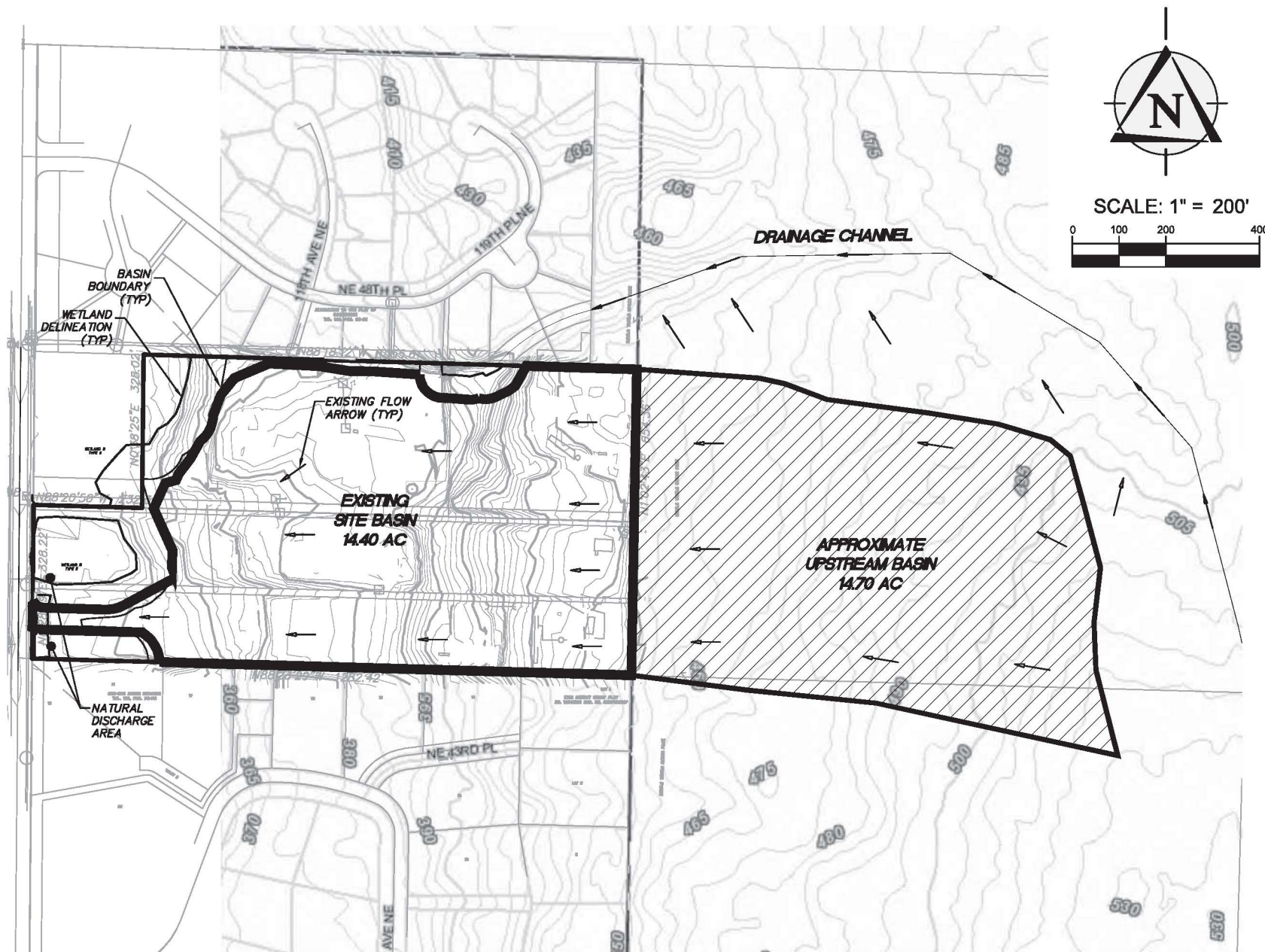


Emergency Overflow Riser

$H_{\text{required}} = 0.47 \text{ feet}$

$H_{\text{provided}} = 0.50 \text{ feet}$

K:\Projects\13097\Drawings\13097 Existing & Developed Conditions - Upstream.dwg, EXISTING
 1/24/2015 1:17 PM
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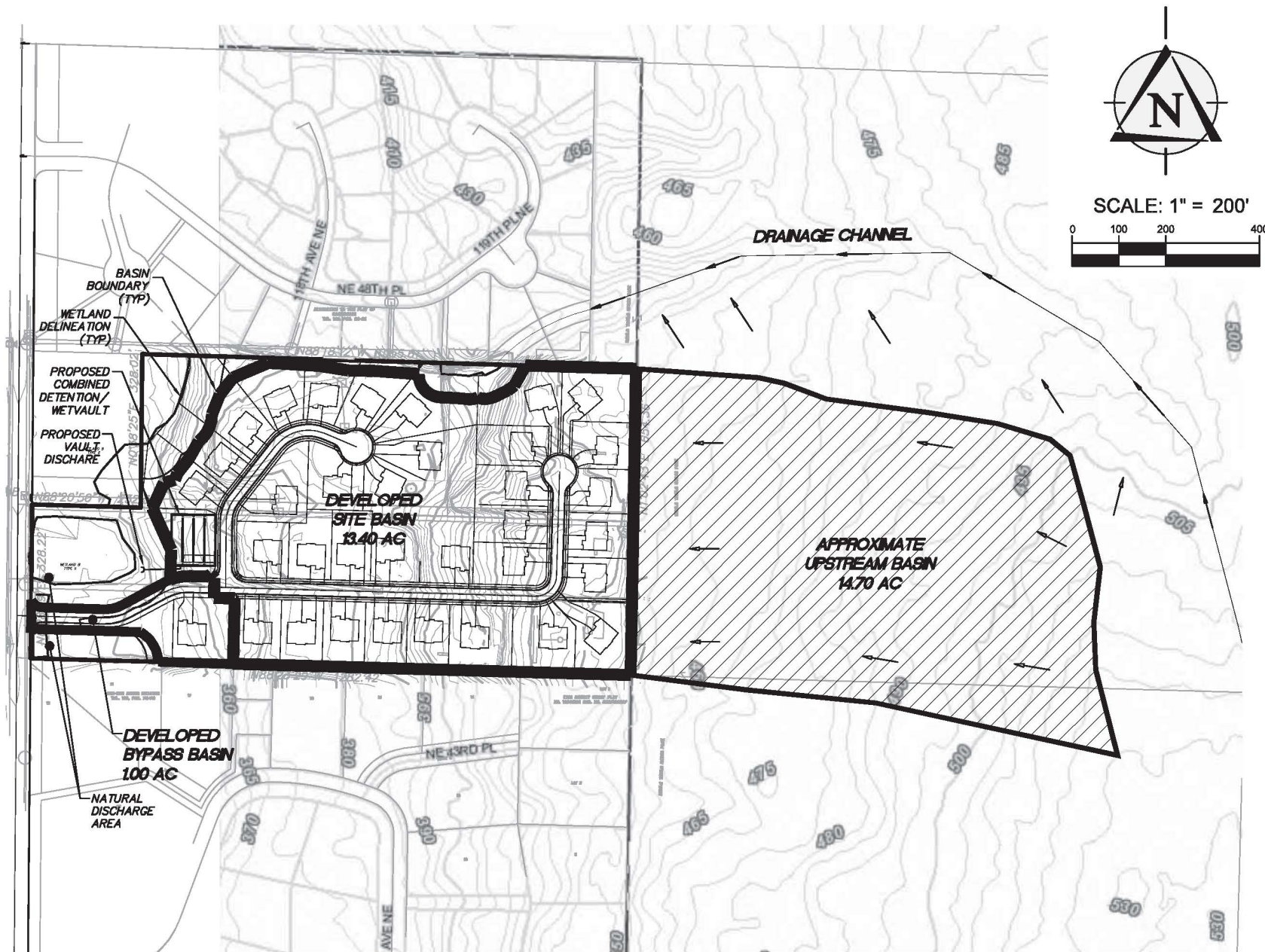
EXISTING CONDITIONS EXHIBIT
KLN CONSTRUCTION, INC.
BRIDLESTONE ESTATES
 CITY OF KIRKLAND
 WASHINGTON

DATE: _____
 DRAWN BY: _____
 CHECKED BY: _____

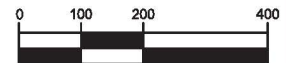
PROJECT MANAGER
 PROJECT SURVEYOR
 PROJECT ENGINEER
 PROJECT LANDSCAPE ARCHITECT
 FIRST SUBMITTAL DATE: 12/16/14
 SCALE: HORIZ. 1"=200' VERT. N/A


STAMP NOT VALID
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 JOB NO. **13-097**
 SHEET NO. **1 1**

KIRKP, Feb 24, 2015 - 1:17PM
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SCALE: 1" = 200'





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 Kirkland, WA 98034-8629
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 425.821.3448 fax
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BRIDLESTONE ESTATES

KLN CONSTRUCTION, INC.

CITY OF KIRKLAND

DEVELOPED CONDITIONS EXHIBIT

DATE: _____

BY: _____

PROJECT MANAGER: _____

PROJECT SURVEYOR: _____

PROJECT ENGINEER: _____

PROJECT LANDSCAPE ARCHITECT: _____

FIRST SUBMITTAL DATE: 12/16/14

SCALE: HORIZ. 1"=200' VERT. N/A

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JOB NO. **13-097**

SHEET NO. **11**

13-097: Bridlestone Estates Area Calculations 14-1202

*Lot Area outside of the Site Basin will remain undisturbed and therefore does not require stormwater mitigation.

**The allowable lot impervious is calculated from the Total Lot Area multiplied by 35% + 800sf. The pervious lots areas are calculated by applying the "Lot Area w/in Site Basin" minus the "Allowable Lot Impervious"

Site Basin - Lot Area Calculations

	Total Lot Area	Lot Area w/in Site Basin	Allowable Lot Impervious**	Lot Pervious w/in Site Basin
1	Bypass	Bypass	Bypass	Bypass
2	14,000	14,000	5,700	8,300
3	12,600	12,600	5,210	7,390
4	12,600	12,600	5,210	7,390
5	12,600	12,600	5,210	7,390
6	12,600	12,600	5,210	7,390
7	18,900	18,900	7,415	11,485
8	18,349	18,349	7,222	11,127
9	19,929	19,929	7,775	12,154
10	13,441	13,441	5,504	7,937
11	13,158	13,158	5,405	7,753
12	12,506	12,506	5,177	7,329
13	13,212	13,212	5,424	7,788
14	20,104	20,104	7,836	12,268
15*	23,692	19,067	9,092	9,975
16	13,015	13,015	5,355	7,660
17	12,700	12,700	5,245	7,455
18	12,506	12,506	5,177	7,329
19	13,961	13,961	5,686	8,275
20	14,208	14,208	5,773	8,435
21	13,125	13,125	5,394	7,731
22	12,750	12,750	5,263	7,488
23	12,569	12,569	5,199	7,370
24	13,313	13,313	5,460	7,853
25	16,897	16,897	6,714	10,183

26	14,505	14,505	5,877	8,628
27	22,815	22,815	8,785	14,030
28	21,442	21,442	8,305	13,137
29*	24,752	17,850	7,048	10,803
30*	15,725	12,787	5,275	7,512
31*	12,561	10,551	5,196	5,355
32*	18,411	14,611	7,244	7,367
33*	22,866	12,803	8,803	4,000
34*	15,387	8,868	6,185	2,683
35*	18,441	10,612	7,254	3,358
			<u>212,630</u>	<u>282,324</u>

Site Basin - Lot Areas

Lot Impervious	212,630 sf
Lot Pervious	282,324 sf

Site Basin - Right of Way/Tracts

Storm Tract Impervious	500 sf
Storm Tract Pervious	14,796 sf
R/W Impervious	64,697 sf
R/W Pervious	8,909 sf

SITE BASIN AREA SUMMARY

Impervious Area	277,827 sf
Pervious Area	306,029 sf
Total Basin Area	<u>583,856 sf</u>

Bypass Basin

Lot 1 Impervious	7,150 sf
Lot 1 Pervious	10,993 sf
Storm Tract Impervious	0 sf
Storm Tract Pervious	6,132 sf
R/W Impervious	15,425 sf
R/W Pervious	3,878 sf

BYPASS BASIN AREA SUMMARY

Impervious Area	22,575 sf
Pervious Area	21,003 sf
	<u>43,578 sf</u>

Western Washington Hydrology Model
PROJECT REPORT

Project Name: BT Detention Vault 14-1202 w Upstream
Site Address:
City :
Report Date : 12/12/2014
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 1.00
WVHM3 Version:

PREDEVELOPED LAND USE

Name : Existing Conditions
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
C, Forest, Mod	29.1

<u>Impervious Land Use</u>	<u>Acres</u>
----------------------------	--------------

EXISTING = 29.10 AC

DEVELOPED + BYPASS = 28.10 + 1.00
= 29.10 AC

Element Flows To:

Surface	Interflow	Groundwater
---------	-----------	-------------

Name : Developed Conditions w Upstream
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
C, Lawn, Mod	7.02
C, Forest, Mod	14.7

<u>Impervious Land Use</u>	<u>Acres</u>
ROADS MOD	1.5
ROOF TOPS FLAT	4.88

Element Flows To:

Surface	Interflow	Groundwater
Vault 1, Vault 1,		

Name : Bypass Basin
Bypass: Yes

GroundWater: No

<u>Pervious Land Use</u>	<u>Acres</u>
C, Lawn, Mod	.49

<u>Impervious Land Use</u>	<u>Acres</u>
ROADS MOD	0.35
ROOF TOPS FLAT	0.16

Element Flows To:

Surface Interflow Groundwater

Name : Vault 1
 Width : 98 ft.
 Length : 98 ft.
 Depth: 16ft.

$$\text{REQUIRED DETENTION VOL.} = 98' \times 98' \times 15' \\ = 144,060 \text{ CF}$$

Discharge Structure

Riser Height: 15 ft.

Riser Diameter: 18 in.

Orifice 1 Diameter: 2.19 in. Elevation: 0 ft.

Orifice 1 Diameter: 3.63 in. Elevation: 10 ft.

Orifice 1 Diameter: 2.06 in. Elevation: 11.25 ft.

Element Flows To:

Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.220	0.000	0.000	0.000
0.178	0.220	0.039	0.053	0.000
0.356	0.220	0.078	0.075	0.000
0.533	0.220	0.118	0.092	0.000
0.711	0.220	0.157	0.106	0.000
0.889	0.220	0.196	0.119	0.000
1.067	0.220	0.235	0.130	0.000
1.244	0.220	0.274	0.141	0.000
1.422	0.220	0.314	0.150	0.000
1.600	0.220	0.353	0.159	0.000
1.778	0.220	0.392	0.168	0.000
1.956	0.220	0.431	0.176	0.000
2.133	0.220	0.470	0.184	0.000
2.311	0.220	0.510	0.191	0.000
2.489	0.220	0.549	0.199	0.000
2.667	0.220	0.588	0.206	0.000
2.844	0.220	0.627	0.212	0.000
3.022	0.220	0.666	0.219	0.000
3.200	0.220	0.706	0.225	0.000
3.378	0.220	0.745	0.232	0.000
3.556	0.220	0.784	0.238	0.000
3.733	0.220	0.823	0.243	0.000
3.911	0.220	0.862	0.249	0.000
4.089	0.220	0.902	0.255	0.000
4.267	0.220	0.941	0.260	0.000
4.444	0.220	0.980	0.266	0.000
4.622	0.220	1.019	0.271	0.000
4.800	0.220	1.058	0.276	0.000
4.978	0.220	1.097	0.281	0.000
5.156	0.220	1.137	0.286	0.000
5.333	0.220	1.176	0.291	0.000
5.511	0.220	1.215	0.296	0.000
5.689	0.220	1.254	0.300	0.000
5.867	0.220	1.293	0.305	0.000
6.044	0.220	1.333	0.310	0.000
6.222	0.220	1.372	0.314	0.000
6.400	0.220	1.411	0.319	0.000
6.578	0.220	1.450	0.323	0.000
6.756	0.220	1.489	0.327	0.000
6.933	0.220	1.529	0.332	0.000
7.111	0.220	1.568	0.336	0.000
7.289	0.220	1.607	0.340	0.000
7.467	0.220	1.646	0.344	0.000
7.644	0.220	1.685	0.348	0.000
7.822	0.220	1.725	0.352	0.000

8.000	0.220	1.764	0.356	0.000
8.178	0.220	1.803	0.360	0.000
8.356	0.220	1.842	0.364	0.000
8.533	0.220	1.881	0.368	0.000
8.711	0.220	1.921	0.372	0.000
8.889	0.220	1.960	0.376	0.000
9.067	0.220	1.999	0.379	0.000
9.244	0.220	2.038	0.383	0.000
9.422	0.220	2.077	0.387	0.000
9.600	0.220	2.117	0.390	0.000
9.778	0.220	2.156	0.394	0.000
9.956	0.220	2.195	0.397	0.000
10.13	0.220	2.234	0.527	0.000
10.31	0.220	2.273	0.598	0.000
10.49	0.220	2.313	0.650	0.000
10.67	0.220	2.352	0.694	0.000
10.84	0.220	2.391	0.733	0.000
11.02	0.220	2.430	0.768	0.000
11.20	0.220	2.469	0.801	0.000
11.38	0.220	2.509	0.871	0.000
11.56	0.220	2.548	0.921	0.000
11.73	0.220	2.587	0.965	0.000
11.91	0.220	2.626	1.004	0.000
12.09	0.220	2.665	1.040	0.000
12.27	0.220	2.705	1.075	0.000
12.44	0.220	2.744	1.107	0.000
12.62	0.220	2.783	1.138	0.000
12.80	0.220	2.822	1.169	0.000
12.98	0.220	2.861	1.197	0.000
13.16	0.220	2.901	1.225	0.000
13.33	0.220	2.940	1.253	0.000
13.51	0.220	2.979	1.279	0.000
13.69	0.220	3.018	1.305	0.000
13.87	0.220	3.057	1.330	0.000
14.04	0.220	3.096	1.354	0.000
14.22	0.220	3.136	1.378	0.000
14.40	0.220	3.175	1.402	0.000
14.58	0.220	3.214	1.425	0.000
14.76	0.220	3.253	1.447	0.000
14.93	0.220	3.292	1.469	0.000
15.11	0.220	3.332	2.032	0.000
15.29	0.220	3.371	3.781	0.000
15.47	0.220	3.410	6.191	0.000
15.64	0.220	3.449	9.112	0.000
15.82	0.220	3.488	12.47	0.000
16.00	0.220	3.528	16.20	0.000
16.18	0.220	3.567	20.29	0.000
16.36	0.000	0.000	24.69	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.74418
5 year	1.160644
10 year	1.387316
25 year	1.618244
50 year	1.755592
100 year	1.868578

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.512931
5 year	0.842124
10 year	1.127411
25 year	1.578702

50 year	1.990594
100 year	2.476237

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.864	0.407
1951	1.669	0.825
1952	1.839	2.430
1953	0.569	0.373
1954	0.436	0.362
1955	0.639	0.426
1956	1.127	0.566
1957	0.964	0.945
1958	0.728	0.439
1959	0.792	0.452
1960	0.655	0.430
1961	1.147	1.260
1962	0.664	0.443
1963	0.387	0.284
1964	0.523	0.398
1965	0.654	0.393
1966	0.488	0.434
1967	0.501	0.367
1968	1.128	0.566
1969	0.667	0.395
1970	0.660	0.372
1971	0.522	0.363
1972	0.475	0.436
1973	1.364	1.167
1974	0.594	0.429
1975	0.641	0.607
1976	0.980	0.483
1977	0.604	0.417
1978	0.060	0.338
1979	0.526	0.480
1980	0.306	0.281
1981	0.886	1.095
1982	0.468	0.409
1983	0.896	0.727
1984	0.812	0.515
1985	0.517	0.344
1986	0.280	0.328
1987	1.414	0.965
1988	1.196	1.045
1989	0.433	0.333
1990	0.274	0.317
1991	1.935	1.482
1992	1.689	1.441
1993	0.558	0.483
1994	0.623	0.347
1995	0.157	0.275
1996	0.886	0.665
1997	1.734	2.252
1998	1.594	1.411
1999	0.324	0.379

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.9349	2.4301
2	1.8387	2.2521
3	1.7344	1.4824
4	1.6894	1.4406
5	1.6691	1.4115
6	1.5937	1.2597
7	1.4136	1.1667
8	1.3638	1.0947
9	1.1960	1.0453
10	1.1467	0.9651
11	1.1283	0.9446

12	1.1268	0.8252
13	0.9797	0.7271
14	0.9642	0.6650
15	0.8957	0.6072
16	0.8861	0.5663
17	0.8856	0.5656
18	0.8637	0.5151
19	0.8121	0.4835
20	0.7919	0.4833
21	0.7277	0.4801
22	0.6671	0.4523
23	0.6637	0.4429
24	0.6600	0.4394
25	0.6545	0.4355
26	0.6543	0.4339
27	0.6413	0.4305
28	0.6391	0.4291
29	0.6233	0.4258
30	0.6038	0.4173
31	0.5943	0.4088
32	0.5690	0.4073
33	0.5580	0.3976
34	0.5265	0.3952
35	0.5228	0.3926
36	0.5216	0.3787
37	0.5170	0.3725
38	0.5009	0.3715
39	0.4877	0.3670
40	0.4755	0.3626
41	0.4679	0.3619
42	0.4358	0.3474
43	0.4329	0.3438
44	0.3874	0.3382
45	0.3237	0.3334
46	0.3056	0.3282
47	0.2797	0.3172
48	0.2740	0.2842
49	0.1575	0.2810
50	0.0598	0.2751

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.3721	3775	3766	99	Pass
0.3861	3490	2999	85	Pass
0.4000	3242	2152	66	Pass
0.4140	3036	1538	50	Pass
0.4280	2848	1361	47	Pass
0.4420	2640	1265	47	Pass
0.4559	2465	1201	48	Pass
0.4699	2285	1152	50	Pass
0.4839	2139	1114	52	Pass
0.4979	2008	1077	53	Pass
0.5118	1892	1051	55	Pass
0.5258	1779	1024	57	Pass
0.5398	1681	997	59	Pass
0.5538	1586	967	60	Pass
0.5677	1497	933	62	Pass
0.5817	1400	911	65	Pass
0.5957	1319	881	66	Pass
0.6097	1243	853	68	Pass
0.6236	1188	831	69	Pass
0.6376	1115	800	71	Pass
0.6516	1056	778	73	Pass
0.6656	1004	746	74	Pass
0.6795	954	724	75	Pass
0.6935	904	704	77	Pass

0.7075	862	677	78	Pass
0.7215	818	651	79	Pass
0.7354	775	620	80	Pass
0.7494	739	600	81	Pass
0.7634	712	575	80	Pass
0.7774	669	552	82	Pass
0.7913	643	520	80	Pass
0.8053	617	492	79	Pass
0.8193	587	472	80	Pass
0.8333	566	452	79	Pass
0.8472	533	442	82	Pass
0.8612	508	434	85	Pass
0.8752	474	421	88	Pass
0.8892	452	412	91	Pass
0.9031	432	398	92	Pass
0.9171	418	387	92	Pass
0.9311	391	376	96	Pass
0.9451	371	362	97	Pass
0.9590	353	348	98	Pass
0.9730	340	337	99	Pass
0.9870	322	330	102	Pass
1.0010	306	319	104	Pass
1.0149	283	309	109	Pass
1.0289	274	293	106	Pass
1.0429	260	284	109	Pass
1.0569	245	271	110	Pass
1.0708	233	257	110	Pass
1.0848	224	237	105	Pass
1.0988	212	230	108	Pass
1.1128	206	223	108	Pass
1.1267	198	212	107	Pass
1.1407	189	203	107	Pass
1.1547	182	189	103	Pass
1.1687	174	179	102	Pass
1.1826	168	173	102	Pass
1.1966	161	166	103	Pass
1.2106	155	151	97	Pass
1.2246	151	146	96	Pass
1.2385	145	137	94	Pass
1.2525	143	128	89	Pass
1.2665	135	114	84	Pass
1.2804	127	107	84	Pass
1.2944	121	100	82	Pass
1.3084	113	90	79	Pass
1.3224	109	82	75	Pass
1.3363	107	75	70	Pass
1.3503	96	66	68	Pass
1.3643	89	59	66	Pass
1.3783	84	55	65	Pass
1.3922	75	51	68	Pass
1.4062	72	47	65	Pass
1.4202	63	43	68	Pass
1.4342	61	36	59	Pass
1.4481	58	28	48	Pass
1.4621	52	23	44	Pass
1.4761	49	21	42	Pass
1.4901	47	15	31	Pass
1.5040	43	14	32	Pass
1.5180	39	14	35	Pass
1.5320	34	13	38	Pass
1.5460	31	12	38	Pass
1.5599	29	10	34	Pass
1.5739	26	9	34	Pass
1.5879	25	9	36	Pass
1.6019	23	9	39	Pass
1.6158	21	9	42	Pass
1.6298	21	9	42	Pass
1.6438	20	9	45	Pass
1.6578	18	9	50	Pass
1.6717	17	9	52	Pass
1.6857	14	8	57	Pass
1.6997	13	7	53	Pass

1.7137	12	7	58	Pass
1.7276	10	7	70	Pass
1.7416	7	7	100	Pass
1.7556	7	7	100	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 1.4166 acre-feet
On-line facility target flow: 0.01 cfs.
Adjusted for 15 min: 1.1258 cfs.
Off-line facility target flow: 0.6013 cfs.
Adjusted for 15 min: 0.6208 cfs.

⇒ REQUIRED WETVAULT VOL. = 61,707 CF

Perlnd and Implnd Changes

No changes have been made.

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5 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

To be addressed at the final engineering stage.

6 SPECIAL REPORTS AND STUDIES

A Geotechnical Report and Critical Areas Report have been prepared for this project and will be submitted as separate documents.

7 OTHER PERMITS

The following approvals/permits will likely be needed for the project (this list may not include all the necessary approvals/permits).

- Preliminary Plat
- SEPA Threshold Determination
- Demolition Permit
- NPDES Permit
- Stormwater Pollution Prevention Plan (SWPPP)
- Clearing and Grading Permits
- Right-of-Way Use Permits
- Utility Permits
- Final Plat Approval
- Building Permits
- Electrical Permits
- Mechanical Permits

8 ESC ANALYSIS AND DESIGN

To be addressed at the final engineering stage.

9 BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

9.1 Bond Quantities

To be addressed at the final engineering stage.

9.2 Facility Summaries

To be addressed at the final engineering stage.

9.3 Declaration of Covenant

To be addressed at the final engineering stage.

10 OPERATIONS AND MAINTENANCE

To be addressed at the final engineering stage.